

## **A Comparative study of dermatoglyphic patterns in patients with primary glaucoma and control group**

Sharmila Pal<sup>1</sup>, Subir Kumar Chattopadhyay<sup>2</sup>, Prasenjit Maity<sup>3</sup>, Sudeshna Roy<sup>4</sup>, Tarun Kumar Danda<sup>5</sup> and Premananda Bharati<sup>6</sup>

1. Professor, Department of Anatomy, Medical College, Kolkata, 88, College Street, Kolkata-700073. e mail [shrmla\\_2006@yahoo.co.in](mailto:shrmla_2006@yahoo.co.in);
2. Professor, Department of Anatomy, MGM Medical College, Kishanganj, Bihar;
3. Professor, Department of Ophthalmology, Murshidabad Medical College and Hospital, Baharampur;
4. Assistant Professor, Department of Ophthalmology, NRS Medical College, 138, A.J.C. Bose Road, Kolkata-700014;
5. B6/13, ECTP Phase 3, Kolkata-700107;
6. Professor, Biological Anthropology Unit, Indian Statistical Institute, 203 B.T. Road, Kolkata 700018.

Corresponding author: Professor, Biological Anthropology Unit, Indian Statistical Institute, 203 B.T. Road, Kolkata 700018. Email: e-mail: [bharati@isical.ac.in](mailto:bharati@isical.ac.in)

### **ABSTRACT**

*Dermatoglyphics are the dermal ridge configurations on the digits, palms and soles. They are permanent and inherited. A comparative study of the Dermatoglyphic patterns of patients with primary glaucoma and general healthy population was made to ascertain the value of Dermatoglyphics as a diagnostic tool for primary glaucoma. Fifty-seven primary glaucoma patients (24 males, 33 females) and fifty normal healthy persons (25 males, 25 females) participated in this study. In the present study primary glaucoma subjects were examined in terms of dermatoglyphic characteristics and compared with that of controls. Frequency of loops was decreased in primary glaucoma but in case of whorls and arch increased numbers. Deviation is also observed in a-b ridge count and atd angle. In general tfrc and afrc also increased. These can be considered as useful as a supportive investigation and to some extent knowing the prediction for primary glaucoma.*

**Key words:** *Dermatoglyphics, Primary glaucoma, Arch, Kolkata*

### **INTRODUCTION**

Dermatoglyphics are the dermal ridge configurations on the digits, palms and soles. These features are found to be permanent variables and are inherited. They begin to develop about the thirteenth week of intrauterine life. The pattern formation is complete by the twenty first week. Once it formed they remain permanent and never change throughout life except in dimension in commensurate to the growth of the individual. They are of importance in anthropology and medical genetics chiefly because of their diagnostic usefulness. The

dermatoglyphic pattern in Down syndrome was conducted by Cummins in 1939 (Polani and Polani, 1969). This study was the first step towards the relation between dermatoglyphics and genetic disorders (Shamsoddini et al., 1997). Subsequently dermatoglyphic pattern was investigated and its correlation studied in various types of affections like schizophrenia, diabetes mellitus, debilitating dementia and psoriasis (Schaumann and Alter, 1976). Bolgir et al. (1993) demonstrated a significant difference on dermatoglyphic pattern between patients with and without family history of schizophrenia which indicated the role of genetic factors in the aetiology of schizophrenia (Bolgir et al., 1993).

Primary glaucoma is characterized by an increase in intra-ocular pressure without an external cause or other disease. Primary glaucoma is of two types-(a) open angle glaucoma (PACG) and (b) angle closure glaucoma (PACG). The formation of tiny channels in the trabecular tissue at the angle of the anterior chamber is completed by the 21<sup>st</sup> week of intrauterine life. The canal of Schlemm appears at about fourth month. The rise of intraocular pressure in POAG is probably caused by interference with aqueous outflow owing to degenerative changes in the trabeculum and Schlemm's canal. In PACG the angle of the anterior chamber is always narrow (less than 20 degrees). Here the root of the iris is inserted comparatively more anteriorly on the anterior surface of the ciliary body.

Glaucoma is becoming an increasingly important cause of blindness as the world population ages. Persons with family history of glaucoma have more risk of developing glaucoma (WHO, 1994). The discovery of specific genetic loci responsible for predisposition to glaucoma has confirmed the family occurrence of the disease (Rezaie, et al., 2002). Extensive studies conducted on the genetic contribution to glaucoma have resulted in an association of primary glaucoma with twenty genetic loci and three genes-MYOC, OPTN and WDR36 (Koolwijk, et al., 2007). The importance of dermatoglyphics in clinical medicine is that, during development, maternal environment, gene deviants and chromosomal aberrations affect ridge formation. Once formed, they are age and environment stable, becoming a reliable indicator of genetic damage (Padmini, et al., 2011).

The knowledge of dermatoglyphic pattern in patients with primary glaucoma is limited as there is little information about this relation. The existence of such relation will be important in screening of individuals susceptible to primary glaucoma. The present study was conducted to investigate the dermatoglyphic pattern in primary glaucoma which may serve as a diagnostic tool for the condition.

## **MATERIALS AND METHODS**

For this study 57 patients (24 males, 33 females) with primary glaucoma from glaucoma OPD of NRS Medical College and Hospital, Kolkata were examined. A control group consisting of 50 normal healthy people (25 males, 25 females) who do not have family history of primary glaucoma was also included.

A history of visual symptoms and detailed family history of glaucoma was taken. Clinical examination including refraction, tonometry, gonioscopy, ophthalmoscopy and visual field

testing was done. The digito-palmar prints were taken by traditional ink method proposed by Cummins and Middlo (1976). The ridges on fingers were classified based on the standard nomenclature (Galton System) into loop, whorl, arch and unknown.

On the fingers the following parameters were calculated- (1) finger ridge count (FRC),(2) total finger ridge count (TFRC), (3) absolute finger ridge count (AFRC). On the palm the following parameters were calculated-(1) number of ridges between digital tri radii a and b (a-b rc), (2) atd angle (measured in degrees).

## RESULTS

Table 1a Distribution of pattern type in control and primary glaucoma patients- both sexes

Subject	No. of individuals	Whorl (%)	Ulnar loop (%)	Radial loop (%)	Arch (%)	X <sup>2</sup>	Remarks
Control individuals	50	125 (25.15)	341 (68.61)	3 (0.61)	28 (5.63)	17.76	Significant
Patients	57	195 (31.76)	360 (58.63)	0 (0.00)	59 (9.61)		

The incidence of whorls, ulnar loops, radial loops and arches were 25.15%, 68.61%, 0.61% and 5.63% in control individuals; in primary glaucoma patients, on the other hand, the percentage frequencies were 31.76, 58.63, 0.0 and 9.61 respectively. The difference in distribution of pattern types between the control individuals and primary glaucoma patients was statistically significant.

Table 1b Incidence of pattern types in control and primary glaucoma patients in relation to Sex

Subject	No. of individuals	Whorl (%)	Ulnar loop (%)	Radial loop (%)	Arch (%)	X <sup>2</sup>	Remarks
Control male	25	45 (17.93)	178 (70.92)	3 (1.19)	25 (9.96)	22.53	Significant
Patient male	24	72 (37.11)	108 (55.67)	0 (0.00)	14 (7.22)		
Control female	25	80 (32.52)	163 (66.26)	0 (0.00)	3 (1.22)	20.91	Significant
Patient female	33	123 (29.29)	252 (60.00)	0 (0.00)	45 (10.71)		

In primary glaucoma males, frequency of the whorl was more than that of the control males (37.11% and 17.93% respectively) but the same of the loop (ulnar and radial) and arch was less in the primary glaucoma than in the control group. The difference between the two groups was statistically significant.

In primary glaucoma female, on the other hand, incidence of the whorl and ulnar loop was lower than that in the control female (29.29% and 32.52%; 60.00 and 66.26 respectively); but the same of the arch was higher in the primary glaucoma patients than that in the control

group. The difference in the incidence between the primary glaucoma and the control female was found to be significant.

Table-1c Sex variation in the percentage frequency of digital patterns in patients

Subject	No. of individuals	Whorl (%)	Ulnar loop (%)	Radial loop (%)	Arch (%)	X <sup>2</sup>	Remarks
Male	24	72 (37.11)	108 (55.67)	0 (0.00)	14 (7.22)	4.67	Insignificant
Female	33	123 (29.29)	252 (60.00)	0 (0.00)	45 (10.71)		

From the above Table it would be evident that the incidence of the whorls, ulnar loops, radial loops and arches of the primary glaucoma males were 37.11 percent, 55.67 percent, 0.0 and 7.22 respectively; in primary glaucoma females, on the other hand, there were only whorls (29.29%), ulnar loops (60.00%) and arch (10.71%). But radial loop is completely absent in primary glaucoma male and females. The sex difference was statistically insignificant.

#### ‘a-b’ ridge count

Table 2 shows mean ‘a-b’ ridge count (both hands) in the control and primary glaucoma patients - both sexes

Subject	No. of Individuals	Mean a-b ridge count	S.D.	t Value	Remark
Control Individuals	50	76.50	9.43	0.77	Insignificant
Primary glaucoma Patients	57	75.05	9.96		

The mean ‘a-b’ ridge count in 50 control individuals was 76.50. The same in 57 primary glaucoma patients was 75.05. The difference between the two mean values was statistically insignificant.

#### ‘atd’ angle:

Table 3 shows mean ‘atd’ angle of in the control individuals and primary glaucoma patients

Subject	No. of Individuals	Mean atd angle	S.D.	t Value	Remark
Control left side	50	41.66	3.06	0.939	Insignificant
primary glaucoma left side	57	40.88	5.44		
Control right side	50	41.02	2.986	0.648	Insignificant
primary glaucoma right side	57	40.54	4.618		

The mean value of 'atd' angle for the left hand of primary glaucoma was 40.88 and that for the control was 41.66. In the right hand of primary glaucoma was 40.54 and control 41.02. Both the hands decrease. The difference between the two means was found to be statistically insignificant at 5% level.

Table 4 Mean 'tfr' of control individuals and primary glaucoma patients

Subject	No. of Individuals	Mean tfr	S.D.	t Value	Remark
Control left side	50	62.74	18.578	1.87	Insignificant
primary glaucoma left side	57	71.42	28.869		
Control right side	50	66.72	14.752	1.99	Significant
primary glaucoma right side	57	74.98	27.120		

The mean value of 'tfr' for the left hand of primary glaucoma was 71.42 and that for the control was 62.74. The difference between the two means was found to be statistically insignificant at 5% level. The mean value of 'tfr' for the right hand of primary glaucoma was 74.98 and that for the control was 66.72. The difference between the two means was found to be statistically significant at 5% level.

Table 5 Mean 'afrc' in the control individuals and primary glaucoma patients

Subject	No. of Individuals	Mean tfr	S.D.	t Value	Remark
Control left side	50	75.94	31.836	1.86	Insignificant
primary glaucoma left side	57	90.61	48.936		
Control right side	50	81.76	26.547	2.20	Significant
primary glaucoma right side	57	96.91	43.630		

The mean value of 'afrc' for the left hand of primary glaucoma was 90.61 and that for the control were 75.94 (Table 5). The difference between the two means was found to be statistically insignificant at 5% level. The mean value of 'atrc' for the right hand of primary glaucoma was 96.91 and that for the control was 81.76. The difference between the two means was found to be statistically significant at 5% level.

## DISCUSSION

The Dermatoglyphic patterns remain unchanged during the lifetime and are inherited. The trabecular meshwork at the ocular angle develops at the same time as the dermatoglyphic pattern and from the same germ layers. The trabecular meshwork and iris are derived from mesoderm whereas the skin is developed from ectoderm and mesoderm. Therefore, genetic

changes that lead to development of POAG and PACG might produce abnormal dermatoglyphic patterns. This is the basis for the comparison of Dermatoglyphic patterns between primary glaucoma patients and phenotypically healthy persons in this study.

Study of Dermatoglyphic traits in different diseases have revealed variations in affected individuals in comparison to normal healthy population. In acute lymphocytic leukaemia lower frequency of whorls have been noticed on fingers (Katia, et.al., 2006). In carcinoma patients higher number of whorls but lower number of arches and radial loops has been found (Aleksnadrowicz, et al., 1966). In diabetes, higher incidence of TFRC and AFRC have been observed. Besides, increased incidence of arch pattern in female diabetics and increased ATD angle in male diabetics have also been recorded (Padmini, et al., 2011).

In the present study significant decrease in the mean of a-b ridge count of left hand was found in primary glaucoma patients of both sexes. This is partially consistent with a previous report which states significantly decreased a-b ridge count of right hand of patients, both males and females, affected by POAG. It is known that variables of the palms are influenced by heredity and environmental factors, the latter having effect only during the short intrauterine period of life (Aleksnadrowicz, et al., 1966). In males the number of ridges in a-b position of the palm is more under the influence of environmental factors while in females the number of ridges in that position has stronger hereditary component (Katia, et al., 2005).

An earlier study reported that the total number of ridges on fingers was higher for phenotypically healthy population than for those affected with POAG. However in the present study, the mean value of TFRC was significantly increased in primary glaucoma patients compared with controls.

In the present study, a significant increase in the incidence of arches was seen in the left hand of primary glaucoma patients and this was reflected in the female patients only. This is partially in variance with a previous study where increased frequencies of arches were found on fingers of male patient only (Katia, et al., 2005).

There are few published studies investigating the differences in dermatoglyphic pattern between primary glaucoma patients and healthy population. The accumulation of consistent observations from epidemiologic studies will provide confidence in the findings.

In conclusion, Dermatoglyphic analysis may help in the screening of persons susceptible to primary glaucoma and early detection of the condition for application of existent therapies.

## REFERENCES

- Aleksnadrowicz SZ, Debski T. 1966. Dermatoglyphics in Lukemia. *Lancet*. **2**: 1364.
- Bolgir RS, Murthy RS, Wig AN. 1993. Genetic loading in schizophrenic (dermatoglyphic study). *Isr. J. Med. Sci.* **29(5)**: 265-268.
- Katia, Novak-Laus, Milicic J, Tedeschi-Reiner E, Ivekoni R, Miju V, Masnec-Paskvalin S, Zrinscak O, Mandie Z. 2006. Analysis of the Qualitative Dermatoglyphics of the Digits-

Palmar Complex in Patients with Primary Open Angle Glaucoma. *Coll. Antropol.* **30**: 163-170.

Katia, Novak-Laus, , Milicic J, Tedeschi-Reiner E, Ivekoni R, Miju V, Masnec-Paskvalin S, Zrinscak O, Zdravko M. 2005. Analysis of the Quatitative Dermatoglyphics of the Digits-Palmar Complex in Patients with Primary Open Angle Glaucoma. *Coll. Antropol.* **29(2)**: 637-642.

Koolwijk ME, Leoneke, Desprich DG, Dominick, Kaur K, Parikh S, Rajul, Manda, Anil K, et al. 2007. Genetic Contribution to Glaucoma. Heritability of Intraocular pressure, Retinal Nerve fibre Larger Thickness, and Optic Disc Morphology, *Investigative Ophthalmology and Visual Science.* **48**: 3669-367.

Padmini M, Pramila, Rao B. Narasinga, Malleswari B. 2011. The Study of Dermatoglyphics in Diabetes of North Coastal Andhra Pradesh Population. *Indian Journal of Fundamental and Applied Life Sciences.* **1(2)**: 75-80.

Polani PE, Polani N. 1969. Chromosome anomalies, mosaicism and dermatoglyphic asymmetry. *Ann. Hum. Genet., Lond.* **32**: 391.

Rezaie TRA, Child R, Hitchings G, Brice R, Miller . 2002. Adult onset primary open angle glaucoma caused by mutations in optineurin. *Science.* **295**: 1077-79.

Schaumann B, Alter M. 1976. Dermatoglyphic in Medical Disorders. Springer Verlag, New York.

Shamsoddini S, Masomi M, Nagal-Hossini M. 1997. Relation between the lines on the finger of hand and the incidence of disease in human. *Scientific Journal of Kuman Medical Science University.* **4(3)**: 136-142.

World Health Organization (WHO). 2004. Glaucoma is second leading cause of blindness globally. *Bulletin of the World Health Organization.* **82**:811-890.

Citation: Pal S, Chattopadhyay SK, Maity P, Roy S, Danda TK and Bharati P. 2013. A Comparative study of dermatoglyphic patterns in patients with primary glaucoma and control group. *Hum Bio Rev*, 2 (3) 223-229.